AMENDMENTS TO THE SPECIFICATION

Please insert a new paragraph into the Specification on page 1, Line 3, below the title "INTEGRATED HERD MANAGEMENT UTILIZING ISOLATED POPULATIONS OF X-CHROMOSOME BEARING AND Y-CHROMOSOME BEARING SPERMATOZOA" and above the heading "I. TECHNICAL FIELD":

> This application claims the benefit of U.S. Provisional Application No. 60/224,050, filed August 9, 2000, and U.S. Provisional Application No. 60/211,093, filed June 12, 2000.

Please replace the paragraph of the Specification on page 6, Lines 16-29, beginning with the words "The invention," with the following amended paragraph:

> The invention involves herd management technology utilizing isolated X-chromosome bearing and Y-chromosome bearing populations of spermatozoa or sperm cells. X-chromosome bearing and Y-chromosome bearing populations of spermatozoa can comprise populations of intact live spermatozoa, or may also comprise frozen populations of X-chromosome bearing and Y-chromosome bearing spermatozoa. While particular examples of the invention are provided in the context of herds comprising beef cattle, it should be understood that the technologies described can have various applications with respect to a variety of species of mammal including, but not limited to, ~~humans,~~ bovids, equids, ovids, canids, felids, goats, or swine, as well as less commonly known animals such as elephants, zebra, camels, or kudu. This list of animals is intended to be exemplary of the great variety of animals from which spermatozoa can obtained and routinely isolated into X-chromosome and Y-chromosome bearing populations and to which this herd management invention can apply. As such, the examples provided are not intended to limit the description of the invention to the management of any particular specie(s) of mammal(s).

Please replace the paragraph of the Specification on page 15, Lines 6-14, beginning with the word "Traditional," with the following amended paragraph:

> Traditional replacement system heifers were managed on triticale pasture with access to native range in YI. In YII, TRS heifers were managed in dry lot conditions due to insufficient grass on native range resulting from drought

conditions. Dry lot ration was balanced ~~according to NRC (68)~~according to NRC and included whole shelled corn, millet hay, and alfalfa hay. Nutritional ~~values for triticale (63)~~values for tritacale and ~~native range (19)~~native range and are listed in Tables 2,3, and 4. Nutritional values are based on 100% inclusion in the diet as amount of each forage in the diet cannot be established, however, triticale was likely the main source of nutrition. Ration samples of the IS heifer diets were periodically collected throughout Phase I and III and analyzed by Olsen's Laboratory McCook, NE (Figures 1,2,3 and 4).

Please replace the paragraph of the Specification on Page 18, Lines 6-8 and Page 19, Lines 1-13, beginning with the words "The IS heifers," with the following amended paragraph:

The IS heifers were managed in feedlot immediately following weaning and continuing for 213 d and 200 d in YI and YII, respectively. Self-feeders were utilized for 140 days in YI and 5 d in YII then bunk-fed for the remainder of Phase I (73 d YI and 195 d YII). The duration of self-feeders utilized in YII was limited due to sickness and necessity to administer medicated feed. The ingredients of the feedlot ration YI included triticale grain, sunflower meal pellet, corn ground alfalfa, protein supplement and Rumensin7. Ingredients of the feedlot ration in YII were similar to YI with the exclusion of sunflower meal pellet. Weight of the EW heifers was measured every 28 d and the ration evaluated and adjusted according to heifer gain. The most important goal of the feeding strategy was for IS heifers to reach 65% of mature weight (based on herd of origin mature weight of 500 kg) by 9 mo of age to induce an early puberty. Therefore each 28 d interval had a goal of 1.36 kg/day gain until heifers began to cycle. At this point the ration energy density was reduced to prevent over fattening and possible subsequent reproduction/calving difficulties. Daily individual intake was calculated by dividing pen intake by total animals in the pen (Figure 5 and 6). Rations were balanced ~~according to NRC (68)~~according to NRC requirements for growing/finishing calves at 1.3 kg/d gain.

Please replace the paragraph of the Specification on Page 20, Lines 10-18 and Page 21, Lines 1-4, beginning with the words "Onset of puberty," with the following amended paragraph:

Onset of puberty and estrous was monitored by behavioral and physiological indicators. The DDx Electronic Heat Watch7 system with the aid of 3 (YI) and 1 (YII) androgenized cows monitored behavioral patterns and the onset of standing heat via mount duration and ~~frequency (96)~~frequency. Androgenization was accomplished by methods described by ~~Nix et al. (67)~~Nix et al. Androgenization of cows was conducted due to the hypothesis that androgenized cows have a similar effect on enhancing puberty through pheromonal cues as hypothesized for bulls. Jugular blood samples of IS heifers

were taken at 10 d intervals for a period of 2 mo (YI) and 3 mo (YII) prior to MGA/PGF synchronization and again 10 d prior to and on day of PGF injection (Figure 7). Serum samples were analyzed for progesterone by ~~radioimmunoassay (21)~~radioimmunoassay. Percent of TRS heifers at puberty was also measured by progesterone assay for one month prior to MGA/PGF synchronization of the IS heifers. Heifers were considered pubertal when serum progesterone concentration was greater than 1 ng/ml within a 10 d ~~period (7)~~period.

Please replace the paragraph of the Specification on Page 21, Lines 21-29, beginning with the words "The IS heifers," with the following amended paragraph:

The IS heifers underwent estrous synchronization accomplished by top dressing feed with 0.5 mg MGA per hd/d for 14 d followed by PGF injection 19 d after the last day of MGA feeding as described by ~~Deutscher (20)~~Deutscher. Heifers were synchronized at 250 " 15.0 d of age YI and 250 " 14.9 d of age YII. Heifers were AI by one of two technicians following standing estrus up to 72 h post PGF injection according to a.m./p.m. protocol. At 72 hr post PGF injection, all remaining pubertal heifers were mated at a fixed-time. A breeding period of 45 d (YI) allowed heifers three or four opportunities to be AI and 24 d (YII) allowed 2 matings. All rebreeds were based on standing heat recorded by Electronic Heat Watch7 and/or visual observation and bred according to a.m./p.m. protocol.

Please replace the paragraph of the Specification on Page 22, Lines 1-5, beginning with the word "Semen," with the following amended paragraph:

Semen used for artificial insemination was collected from two Black Angus bulls (YI) and one Black Angus bull (YII) with low birth weight EPD of 0.5, 1.5 and B 1.43, YI and YII, respectively. Semen was sorted using flow cytometry, selected for X-~~chromosomal sperm (82)~~chromosomal sperm. Semen doses for insemination contained three million sperm (YI) and six million sperm (YII) per dose with at least 35% post thaw motility.

Please replace the paragraph of the Specification on Page 23, Lines 12-16, beginning with the words "The IS heifers," with the following amended paragraph:

The IS heifers were turned on to native range at an average age (calculated from the final 22 IS heifers) of 297 " 12.6 days of age. The heifers remained on pasture for 237 days at which time the first IS heifer gave birth (534 " 12.6 d of

age). Weight of IS heifers were recorded on the first and last day of this phase. Forage nutritional values are reported in ~~Tables 2 and 4 (19)~~Tables 2 and 4.

Please replace the paragraph of the Specification on Page 25, Lines 1-6, beginning with the words "The IS heifers," with the following amended paragraph:

The IS heifers were placed on feedlot ration at 534 " 12.6 d of age until 696 " 12.6 d of age for 162 d. Ingredients included triticale grain, whole shell corn, and alfalfa (Figure 3 and 4). The ration was balanced ~~according to NRC (68)~~according to NRC requirements for lactating 550 kg cows and adjusted according to IS heifer and calf performance. Daily intake was calculated by dividing group intake by the number of animals in the pen (Figure 8). Integrated system heifer and IS calf weight was recorded every 28 d.

Please replace the paragraph of the Specification on Page 26, Lines 4-10, beginning with the word "Carcasses," with the following amended paragraph:

Carcasses were tracked from the kill floor to the cooler on the day of harvest. Approximately 36 h postmortem, USDA Quality Grade factors (skeletal maturity, lean maturity and marbling) and USDA Yield Grades (longissimus muscle area, hot carcass weight, and estimated percent of kidney pelvic and heart fat) ~~were recorded (103)~~were recorded. Strip loins were collected from each IS heifer carcass. Loins were taken to Colorado State University, aged for 14 days at 2EC then frozen (-29E C) until strip loin sections were sawed into steaks (2.54 cm thick).

Please replace the paragraph of the Specification on Page 26, Lines 13-20 and Page 27, Lines 1-4, beginning with the words "Strip loins," with the following amended paragraph:

Strip loins were removed from the freezer cut into 2.54 cm steaks which were then thawed in a refrigerated cooler (4EC) for 24 hrs. Steak temperature was monitored to ensure steak temperatures were between 1EC and 5EC immediately prior to cooking. Steaks were cooked to 70EC internal temperature using a Magikitch=n belt grill (Magigrill model TBG-60; Magikitch=n Inc., Quakertown, PA); (top heat=177EC, bottom heat=177EC, preheat=disconnected, height=1.85cm, cook time=6.55 min). Final endpoint temperatures were monitored using a handheld thermometer (Omega model HH21 thermometer; Omega Engineering, Inc., Stamford, CT). Cubed samples of each cooked steak were served to a sensory panel. Panelists were trained for two weeks according to procedures outlined by ~~Meilgaard et al. (57)~~Meilgaard et al. and ~~AMSA~~

~~(3)~~AMSA. Panelist scored the samples for juiciness, muscle fiber tenderness, overall tenderness, connective tissue and amount of flavor intensity using an ~~8-point scale (3)~~8-point scale.

Please replace the paragraph of the Specification on Page 27, Lines 6-13, beginning with the word "Steaks," with the following amended paragraph:

Steaks for the Warner-Bratzler shear force values were handled and prepared in the same manner as stated above. The steaks were allowed to cool to room temperature (24EC) before removing six to ten cores (1.27 cm in diameter) parallel to the steak ~~muscle fiber (3)~~muscle fiber. Each core was sheared once using Warner-Bratzler shear machine. Individual peak shear force values were averaged to obtain a final representative shear force value for each steak. The WBS threshold of 4.5 kg determined carcass classification of ~~tough or tender (89)~~tough or tender. Carcasses with WBS values greater than 4.5 kg were considered "tough", whereas carcasses with WBS values less than 4.5 kg were considered "tender".

Please replace the paragraph of the Specification on Page 33, Lines 1-14, beginning with the word "Statistical," with the following amended paragraph:

Statistical analyses were completed using the general linear model (GLM) ~~procedure of SAS (81)~~procedure of SAS and when appropriate, means were separated using ~~Tukey's HSD (81)~~Turkey's HSD to determine differences in weights, age, and BCS across years. Logistic regression and ~~contrasts (81)~~contrasts were used with first service or second service resulting pregnancy as the dependent variable; group and heat cycles or group and technician were considered independent variables respectively, to compare and contrast technician, sire, and semen effects within and across years. Group refers to the combination of sexed or non-sexed semen from one of three sires to yield four groups, one sire (YI) with both sexed and non-sexed semen used for insemination of IS heifers, and two sires (YII) with only sexed semen used for insemination of IS heifers. Chi square and correlation ~~analyses (81)~~analyses were conducted on taste panel characteristics (maturity, session, juiciness, muscle fiber tenderness, presence of connective tissue, overall tenderness, and flavor intensity) and calving characteristics (calf vigor, calving ease, calf sex, and sire). Data collected on animals that died during the trial were not used in the statistical analyses.

Please replace the paragraph of the Specification on Page 33, Lines 18-30 and Page 34, Lines 1-6, beginning with the word "Integration," with the following amended paragraph:

Integration of early-weaning and sexed semen into a SCH system was studied and a final economic analysis was conducted to establish profitability. In the first year 46 heifers of non-replacement status (IS heifers) were early weaned (EW) at 110 " 15.0 d of age at 141 " 21.1 kg. Forty heifers of replacement status (TRS) were traditionally weaned (TW) at 229 " 2.8 d of age at 262 " 25.40 kg. At time of TW, YI IS heifers were 202 " 15.0 d of age and weighed 249 " 6.8 kg. The YI TRS heifers were 27 " 12.2 d of age older ($P < 0.01$), than the YI IS heifers and had greater weights at time of TW. From EW to TW, the dams of the YI IS heifers had greater BCS than dams of YI TRS heifers, 6.6 " 0.80 and 5.8 " 0.78 ($P < 0.01$), as a result of lactation ending and allowing for increased biological utilization of grazing forage nutrition. ~~Myers et al. (64)~~Myers et al. and ~~Story et al. (97)~~Story et al. also reported an increase in dam BCS and subsequent increased reproduction rate of 12% (64). Reproduction rate in the current study was not affected by early weaning as all dams were managed to a constant BCS prior to breeding. The dams of the YI IS heifers were put on winter range without additional supplementation under weight-loss management conditions. The dams of the TRS heifers were also put on winter range managed to maintain or gain BCS. During the winter period, the dams of the YI TRS heifers required very little supplementation due to the mild winter in Akron, CO in 1999-2000. Early weaning the YI IS heifers had the very minor economic benefit of $7.06 per dam less wintering cost than the dams of the YI TRS heifers as very little supplement was needed regardless of weaning strategy.

Please replace the paragraph of the Specification on Page 34, Lines 20-25, beginning with the word "Early," with the following amended paragraph:

Early weaning heifer calves in this study resulted in increased dam BCS YI as well as faster rates of gain than contemporaries that remained on dam. This is in agreement with ~~Richardson et al. (95)~~Richardson et al., Grimes and ~~Turner (5)~~Turner, and ~~Schoonmaker et al. (85)~~Schoomaker et al. At the time of traditional-weaning YI and YII IS heifers that were early-weaned were not heavier than the YI and YII TRS heifers that were traditional-weaned as ~~Peterson et al. (70)~~Peterson et al. reported, however, weight per day of age (WDA) was greater for IS heifers than TRS heifers in YI.

Please replace the paragraph of the Specification on Page 37, Lines 1-17, beginning with the word "Induction," with the following amended paragraph:

Induction of early puberty of the IS heifers is attributed to the high plane of nutrition of the IS heifers. This conclusion is supported by ~~Roux et al. (78)~~Roux et al. who reported a high plane of nutrition induced earlier onset of puberty and an increased percent of heifers with regular estrous cycles. ~~Schillo et~~

~~al. (83)~~Schillo et al. hypothesized that nutritional status affects timing of increasing LH pulses and may involve the LH pulse generating system in the hypothalamus through an unknown mechanism. ~~Kinder et al (44)~~Kinder et al. stated that changes in body mass or fatness somehow affect LH pulses. Pre-pubertal heifers fed limited amount of energy had prolonged estradiol suppression and release of LH pulses compared to those fed a high-energy diet. High-energy diets are thought to result in larger dominant follicles earlier in life. Although plane of nutrition is inversely related to age at puberty, pattern of gain has no effect on age at ~~puberty (33)~~puberty as long as heifers reach approximately 60-65% of mature ~~body weight (51)~~body weight prior to breeding. Likewise, the pattern of gain in the current study did not affect the onset of puberty. The addition of rumensin in the diet is also thought to have hastened the onset of puberty. ~~Randel (27)~~Randel summarized several studies and found diets that had high propionate production in the rumen led to puberty at lighter weights. Similarly, ~~Moseley et al. (62)~~Mosely et al. and ~~Purvis and Whittier (72)~~Purvis and Whittier found that diets containing ionophores decreased the age at onset of puberty, not related to ADG or BW.

Please replace the paragraph of the Specification on Page 37, Lines 19-25, beginning with the word "Weight," with the following amended paragraph:

Weight of heifers seemed to have more influence than age on puberty (Table 7). The IS heifers that reached puberty at less than 9-mo of age were similar in age ($P = 0.66$) and weight ($P = 0.15$). However, the IS heifers that reached puberty at greater than 9-mo of age were of similar weight ($P = 0.44$) but different ages ($P < 0.01$). The IS heifers in YI and YII that reached puberty prior to PGF injection were of similar weight ($P = 0.29$) and age ($P = 0.66$). This supports data that weight of heifers tend to have a greater impact on the timing of puberty ~~than age (4,78,79)~~than age.

Please replace the paragraph of the Specification on Page 38, Lines 3-14, beginning with the word "Heifers," with the following amended paragraph:

Heifers that became pregnant to sexed semen on the first service of AI was 23% and 8% of those cycling and fixed-time mated, YI and YII respectively (Table 8). Overall conception rate and pregnancy rates were 71% and 58% YI and 21% and 16% YII. The low conception rate may be due to any one or a combination of properties of semen used such as low numbers and motility of semen in each dose (3×10^6 YI and 6×10^6 YII, with at least 35% post-thaw motility). ~~Seidel et al. (87)~~Seidel et al. found low-dose sexed-semen to lower conception rate by 10-20% over normal-dose non-sexed semen. In YII pregnancy rate within each insemination was not affected by sexed semen sorted

for X chromosome than non-sexed semen of the same dose ($P = 0.51$) for either first-service or second service ($P = 0.56$). Likewise, sires within YI and across YI and YII had no affect pregnancy as a result of first service ($P = 0.87$ and $P = 0.45$, YI and YII respectively). Technician also had no effect on pregnancy in YI ($P = 0.93$) and YII ($P = 0.96$).

Please replace the paragraph of the Specification on Page 39, Lines 11-13, beginning with the word "Pregnancy," with the following amended paragraph:

Pregnancy as a result of the first artificial insemination on a first or subsequent estrus did not have an affect on pregnancy ($P = 0.97$). This result is in contrast to ~~Byerley et al. (16)~~Byerley et al. whom concluded that the first estrus was less fertile than the third estrus.

Please replace the paragraph of the Specification on Page 40, Lines 19-20 and Page 41, Lines 1-6, beginning with the word "Twelve," with the following amended paragraph:

Twelve of the 20 (60%) calves born were female (Table 9). Eleven of the 16 (69%) calves conceived from semen sorted for X-chromosome were female and all three calves conceived from non-sexed semen were bulls (100%) whereas the only calf born to natural serve was female (100%). ~~Seidel et al. (87)~~Seidel et al. reported that 86% of calves conceived from sexed semen are of the desired sex. The result of this data set of 69% of calves conceived to sexed semen were of desired sex, is not an adequate replication of their study as too few individuals were used. The low percent of desired sex was not expected as the true percent of X-chromosome sperm varied from 86-92% for the batches of semen used in the study.

Please replace the paragraph of the Specification on Page 41, Lines 22-30 and Page 42, Lines 1-8, beginning with the words "The high incidence," with the following amended paragraph:

The high incidence of dystocia is consistent with data reported by ~~Boucque (11)~~Boucque. He reported that 24 and 25-mo-old SCH Belgian White heifers bred to Charolais sires resulted in caesarean procedures on 30-37.5% and 15-25% stillbirth or death within 24 h postpartum. The high incidence of dystocia was probably due to high calf birth weight (43.8 kg and 43.9 kg). ~~Roux et al. (78)~~Roux et al. reported similar calving difficulties in 10 mo old Friesian and Friesian X Charolais heifers bred to Aubrac and Angus sires; 39% assisted by a manager and 5% required veterinarian intervention. Incidence of calving

difficulties has also reported by ~~Bailey (5)~~Bailey using crossbred heifers; bred to Texas Longhorn sires less than 4% dystocia occurred, but when mated to Red Angus sires had 28% dystocia. ~~Roux et al. (78)~~Roux et al. also found that heifers experiencing dystocia had significantly smaller pelvic measurements than heifers that calved unassisted. In the current study, no pelvic measurements were recorded in YI; however, pelvic measurements of YII IS heifers were not different to YII TRS heifers; it can be speculated that YI results would have been similar. ~~Coleou et al. (17)~~Coleou et al. reported very similar calving difficulties to the current study. In their study of Normand heifers calving at 19 mo of age, 31% required assistance, 14% experienced prenatal mortality of calves and there was 29% total mortality of calves before 3 months of age. Likewise, these calves had high birth weights of 38.5 kg.

Please replace the paragraph of the Specification on Page 42, Lines 10-15, beginning with the word "Other," with the following amended paragraph:

Other researchers have also found that calf loss due to dystocia depends highly on level of supervision during ~~calving (18)~~calving. ~~Simon et al (91)~~Simon et al. reported that under typical feedlot conditions, pregnant feedlot heifers displayed 29% calf death loss. They also reported that the high incidence of dystocia is due to a lack of facilities and unfavorable calving conditions. Nevertheless, a producer must use selection to optimize both calving ease and progeny value according to the management ~~ability (13)~~ability.

Please replace the paragraph of the Specification on Page 42, Lines 17-29, beginning with the word "Integrated," with the following amended paragraph:

Integrated System heifer and calf performance was acceptable in the feedlot. Weaning weights of IS calves averaged 116 " 26.1 kg at 109 " 16.7 d of age and overall average daily gain of 1.0 " 0.08 kg. Average daily gains for the IS heifers varied from 1.6 " 1.03 kg during late gestation to early lactation and then decreased to 0.4 " 0.34 kg during late lactation to weaning and increased from weaning to harvest to 1.4 " 0.31 kg. Average daily gain over the 157 d PIII feeding period for IS heifers was 1.4 " .31 kg. The IS heifer performance was fairly constant over all heifers. This may be because a high level of cross suckling occurred, so even though difference in calf age was high, each dam probably milked the same amount. Heifers that lost their calves at birth or shortly there after, continued to lactate to help support calves of other dams. Other researchers have also noted a high incidence of cross suckling among SCH rearing calves under feedlot ~~conditions (13,35)~~conditions. Total live-weight produced from the final twenty-two IS heifers and calves was 894 " 65.7 kg. No mortality or morbidity was experienced by the IS heifers during Phase III.

Please replace the paragraph of the Specification on Page 43, Lines 1-10, beginning with the word "Brethour," with the following amended paragraph:

> Brethour and ~~Jaeger (13)~~Jaeger reported that for each day delay in weaning, calf gain was 0.54 kg while gain of the dam was reduced by the equivalent amount. They therefore early weaned calves at 10-12 weeks (70-90 d) of age. The current data also found that as lactation increased to support greater calf gain, dam gain decreased. Once calves were removed, gain increased for the IS heifers. However, it must be noted that only five animals ever experienced weight loss at any point during PIII and weight loss never exceeded 0.6 kg/d with in a 28 d weigh period. This weight loss may not have been body tissue, rather, may be attributed to gut fill as animals were not fasted prior to weighing nor were weights measured two consecutive days to minimize gut fill affect on weights.

Please replace the paragraph of the Specification on Page 43, Lines 11-21, beginning with the word "Reiling," with the following amended paragraph:

> ~~Reiling et al (74)~~Reiling et al. managed postpartum SCH in a feedlot on 85% concentrate diet at 13.4% CP. He noted that calves weaned at 117 d of age weighed 159 kg. Their results show better feedlot performance than the current study, however, ~~Reiling et al (74)~~Reiling et al. weaned calves at an older age. They also reported that at the time of weaning, SCH had sub-cutaneous fat at a depth of 1.1 cm whereas, in the current study, IS heifer BF was 0.27 cm as determined by ultrasonography. In the current study, postpartum SCH were managed on 96% concentrate diet at 11.8% CP. The difference in performance between the two studies cannot be explained entirely by diet. However, varying season, genetics, and lactation ability may explain some of the difference. Brethour and ~~Jaeger (13)~~Jaeger found performance of SCH to be uneven, the previous comparison demonstrates variability in the system in relation to time, genetics, and management.

Please replace the paragraph of the Specification on Page 43, Lines 24-30 and Page 44, Lines 1-17, beginning with the words "The IS heifers," with the following amended paragraph:

> The IS heifers were harvested at 715 " 15.0 d of age (24-mo) weighing 613 " 46.1 kg. Colorado State University personnel and a USDA Grader measured means and standard deviations of carcass characteristics (KPH, fat thickness, degree of marbling, ribeye area, lean maturity scores, and bone maturity scores) (Table 11). Eight of the 22 IS heifers received bone maturity

score of "B." However, all had lean maturity scores of "A" (Table 10), and only four of the 8 carcasses resulted in overall "B" maturity scores. These results support the theory proposed by other researchers, that pregnancy and lactation affect bone ossification to a greater extent than lean maturity scores (Table 12). ~~Field et al. (76)~~Field et al. reported the most exaggerated trend; 18 head of 33-mo-old SCH had lean maturity of "A" but bone maturity "C" According ~~to USDA (103)~~to USDA, carcasses with "C" skeletal or lean maturity will remain "C" maturity regardless of the other physiological score. Overall maturity remained "C" maturity. ~~Waggoner et al. (105)~~Waggoner et al. reported average overall carcass maturity scores of the SCH were "B" (105 " 3.0), bone maturity score of "B" (116 " 3.6), and lean maturity score of "A" (80 " 3.2) with only 3 of 84 carcasses reported as AC@ maturity. ~~Field et al. (26)~~Field et al. reported that parity did not affect lean firmness. However, lean color tended to be darker as animal aged from yearling maiden heifers to 2-yr old maiden heifers. Pregnancy of 30-mo old SCH resulted in lighter lean color than 2-yr old maiden heifers. Some studies reported maiden females had greater maturity scores in ~~lean color (5,74,104,105)~~lean color. ~~Hermesmeyer et al. (35)~~Hermesmeyer et al. reported that lactating SCH had greater lean maturity scores than did open heifers of the same age, but bone maturity scores did not differ. Therefore, overall maturity scores were greater for SCH than open heifers. In contrast, other research data found no difference between lean color of SCH and maiden ~~heifers (10,14,26,78)~~heifers. In the current study, effect of pregnancy and lactation as separate factors on bone and lean maturity could not be accessed as the IS heifers that lost their calves continued to lactate as a result of cross-suckling.

Please replace the paragraph of the Specification on Page 46, Lines 1-14, beginning with the words "The IS heifers," with the following amended paragraph:

The IS heifers deposited intramuscular adequately as most were of Choice quality grade. However, due to the influence of "B" maturity, 4 carcasses were graded Standard. The occurrence of Standard carcasses are of major economical concern as these carcasses were discounted by $11.87/cwt under the base price and Choice carcasses were given premiums of only $0.97/cwt over the base price (Table 5). With this particular grid, it would take about 12 Choice carcasses to compensate for the discounts of a single Standard carcass of the same Yield Grade and weight. ~~The USDA (103)~~The USDA made a change to the role of which B maturity plays in quality grades. Currently, B-maturity carcasses with less than modest degree of marbling will be graded standard; those carcasses with at least modest degree of marbling will receive the Choice grade or better. The new grading standard may increase the incidence of heiferetts graded ~~Standard (75)~~Standard from studies conducted on SCH studies in the past. Standard grade of a carcass is associated with discounts and may be a major economic impact on profitability of ~~feeding SCH (26,74,100,105)~~feeding SCH.

Please replace the paragraph of the Specification on Page 46, Lines 16-24, beginning with the words "In the current study," with the following amended paragraph:

In the current study, only 1 of the 4 "B" maturity carcasses remained in Choice quality grade due to Modest degree of marbling, whereas before the grade standard change, all 4 carcasses would have been graded Choice. Likewise, many previous studies that reported a high incidence of Choice carcasses would now result in lower grade of Standard. ~~Hermesmeyer et al. (36)~~Hermesmeyer reported that 74% of the SCH received USDA Choice, YG 3. Likewise, ~~Reiling et al. (75)~~Reiling et al. reported that approximately 50% of SCH would have received USDA Choice under the old USDA Grade ~~Standards (102)~~Standards. However, under current USDA ~~Standards (103)~~Standards the percent of heiferetts that would receive the same grade would decrease to about 40%.

Please replace the paragraph of the Specification on Page 46, Lines 26-30 and Page 47, Line 1, beginning with the words "The results," with the following amended paragraph:

The results of this study are similar to the carcass characteristics found by many other SCH system studies (Table 12), even though animals were 24-mo of age compared to 30-mo old heifers. However, several studies have reported some carcass maturity ~~scores of "C" (26,74,75,105)~~scores of "C". In the current study, no incidence of "C" maturity occurred. Similarly, ~~Brethour and Jaegar (13)~~Brethour and Jaeger and ~~Waggoner (105)~~Waggoner found no carcasses with carcass maturity scores of "C".

Please replace the paragraph of the Specification on Page 47, Lines 6-19 and Page 47, Lines 1-6, beginning with the word "Waggoner," with the following amended paragraph:

~~Waggoner et al. (105)~~Waggoner et al., ~~Joseph and Crowley (42)~~Joseph and Crowley, and ~~Bond et al. (10)~~Bond et al. reported that juiciness and flavor was not affected by parity nor was sensory panel tenderness. ~~Waggoner et al. (105)~~Waggoner et al. reported that sensory panelists found detectable connective tissue, myofibrillar and overall tenderness to be higher for yearling maiden heifers than either SCH or 2 yr-old maiden heifers. The WBS values were higher for SCH than maiden heifers. Therefore, calving had a negative affect on tenderness. Age increased sensory panel detectable connective tissue and the combined affect of age and parturition decreased tenderness over yearling maiden heifers. However, tenderness and palatability traits did not differ between 2 yr-old maiden heifers and SCH. Therefore, the SCH system resulted in meat palatability comparable to maiden heifers of a similar age as determined by sensory panelists. ~~Vincent et al. (104)~~Vincent et al. reported SCH did not differ in sensory panel

ratings except for the oldest (33 mo of age) SCH, which had greater connective tissue. ~~Joseph and Crowley (42)~~Joseph and Crowley finished Hereford crossbred maiden heifers and SCH on pasture and reported that calved heifers appeared to be as acceptable to sensory panelists as maiden heifers and both were nearly as acceptable as steers. There was no significant difference in tenderness, juiciness or flavor between maiden heifers and SCH heifers. In the current study, 8 panelist rated the meat from the IS heifers quite acceptable. On an 8-point scale, panelists rated the steaks moderately juicy (6 " 0.99), moderate in muscle fiber tenderness (6 " 1.1), trace amount of connective tissue present (6 " 1.1), moderate in overall tenderness (6 " 0.95) and a flavor that is slightly detectable (1 " 0.61).

Please replace the paragraph of the Specification on Page 48, Lines 8-20, beginning with the word "Classification," with the following amended paragraph:

Classification of carcasses maturity as "A" or "B" did not affect any of the taste-panel characteristics evaluated ($P > 0.3$). Although increasing carcass maturity is associated with a decrease in tenderness, juiciness and an increase in flavor intensity and off flavors, ~~Hilton et al. (37)~~Hilton et al. similarly found position within a maturity group had a negligible effect on palatability. Likewise, other researchers have reported sensory taste panel traits were undifferentiated between "A" and "B" maturity ~~carcasses (99)~~carcasses. In contrast to these studies and the current study, ~~Smith et al. (93,94)~~Smith et al. reported steaks from "A" and "B" maturity carcasses, within equal marbling scores, were significantly different. The correlation between "A" and "B" maturity classifications are not clear and further research studies have provided evidence that has contributed to the confusion of the discrepancy between "A" and "B" maturity classifications and palatability. However, the combined effects of marbling and maturity, accounts for 30-40% of the observed variation in tenderness, 26% of the variation in juiciness, and 15% of variation in ~~flavor (37)~~flavor.

Please replace the paragraph of the Specification on Page 48, Lines 22-25, beginning with the words "All 22 steaks," with the following amended paragraph:

All 22 steaks from the IS heifers were tender. The average Warner-Bratzler Shear force (WBS) value was 2.9 " 0.9. No incidence of tough steaks occurred in the current study as no steak exceeded WBS ~~value of 4.5 (89)~~value of 4.5. It is therefore concluded that steaks for 24-mo old SCH managed in the IS provide consumers with a highly palatable product.

Please replace the paragraph of the Specification on Page 53, Lines 4-13, beginning with the words "Any acts of law," with the following amended paragraph:

Any acts of law, statutes, regulations, or rules mentioned in this application for patent; or patent, publications, or other references mentioned in this application for patent are hereby incorporated by reference herein. Specifically, United States Provisional Patent Application No. 60/094,720, filed on July 30, 1998, and United States Provisional Patent Application No. 60/113,143, filed on December 18, 1998, and PCT/US98/27909, and U.S. Patent Application No. 09/448,643, filed on November 24, 1999, and U.S. Patent Application No. 09/511,959, filed on February 23, 2000, and United States Provisional Patent ~~Application Nos.~~Application No. 60/211093, filed on June 12, 2000, and United States Patent Application No. 09/582,809, filed on June 30, 2000, and United States Provisional Patent Application No. 60/224,050, filed on August 9, 2000, and United States Patent Application No. 09/001,394, filed on December 31, 1997 and United States Patent Application No. 09/015,454, filed January 29, 1998 and PCT/US99/17165, filed July 28, 1999, and "Cost Effectiveness of Utilizing Sexed-Semen in a Commercial Beef Cow Operation," thesis of Nanette Lynn Steel, Department of Agriculture and Resource Economics, Summer of 1998 are each hereby incorporated by reference.